Scientist Devotes Thirty-five Years to Study of Snowflakes

Calls Them Fairest Sight He Has Encountered in the Wonderland of Nature

W. A. Bentley Takes 3,800 Pictures But Says He Has Found No Two Crystals Alike

By Tom Steep

NATURE in her most whimsical moods has created nothing more wonderful than that which she ...ntly drops from a winter's cloud—a snowflake. The fairylike beauty ...shrined in a minute particle of ...zen moisture which we ruthlessly ...sh under foot surpasses in variety ...d delicacy of effect any decora...ve design contrived by man.

Such are the conclusions of Wilson Alwyn Bentley, who for thirty-five ...ars has devoted his time and ...ought to a scientific study of snow...kes, raindrops, dew and clouds. ...n this time he has taken 3,800 ...otomicrographs of snowflakes and ...und that no two of them are ever ...actly alike. Nature's wonderland, ...e says, is not more manifested in ...e infinitely big than in the in...itely small, and if his eyesight ...ere keener man would become as ...ouch fascinated in contemplating a ...owflake or a dewdrop as he now ...s in gazing into the starry heavens.

Beginning in a humble way as a ...y, Mr. Bentley, who lives at ...ericho, Vt., and is known as the "farmer scientist," has developed ...is study until to-day he is recog...ized as the world's authority on ...e subject of snowflakes. He has ...en the first to devise a means ...hereby the snowflake, the most ...anescent of nature's phenomena, ...n be photographed and enlarged ...th exactness and within a mo...ent after the delicate and feathery ...essenger has wafted its way to ...arth. The rigorous winters of Ver...ont have been particularly favor...ble to Mr. Bentley's investigations, ...or at his home in Jericho the snow ...lls often and deep, and in his lit...le laboratory, where he has his ...icroscopes and photographic ap...aratuses projected through a win...ow he has been able to show the ...orld for the first time that an ...rdinary snowflake often contains ...rmations more intricate and deco...ative than any design of the ...weler's art. Frost crystals, of ...hich he has taken more than 400 ...otographs, clouds and raindrops ...ave been a passion with Mr. Bent...y, but his hobby has been snow...kes. It is perhaps because the ...ake, subject to changes by evapo...ation even in the severest cold and ...kely to melt as soon as it touches ...e earth, is a more elusive study. ...t requires greater preparation and ...icker action. A photograph of a ...ake may be said to be the most ...stortived of all of nature's mani...estations.

"Let the snow clouds once ap...pear over the horizon and down goes hoe, shovel or any other farm tool with which I may be working," says Mr. Bentley. "For I would abandon anything to welcome a snowflake.

Welcomes the Snowflakes

"I inherited a great love of nature study from my parents. The very first money I ever earned in my early teens I invested in a microscope and telescope instead of in guns, watches and whistles. The marvelous beauty of snowflakes early attracted my attention. I first made about four hundred drawings of them. Drawings proved utterly unsatisfactory. I enjoyed them so intensely, however, that it led to an overmastering desire to have others see and enjoy them, too. When I learned that dry plate photography made the photographing of them possible I procured an apparatus, a camera coupled to a microscope, giving from eight to sixty diameters magnification (64 to 3,600 times), and after many failures and discouragements secured my first photomicrograph during my nineteenth year (1885). The lure of the snowflakes has compelled me to continue the unique photographic study ever since. Every winter finds me always on duty when good snowflakes are falling. And business, pleasure, cold, hunger, meals—everything—is forgotten or neglected.

"It is hard to convey an idea of the extreme fascination of the work. Sometimes the snows are extremely rich in beautiful forms and one is in despair as to which to select to photograph. Again, one must search all day long perhaps to find a few perfect ones. Favorable snows come from four to fifteen times during a given winter, falling usually from the western segments of general storms. Every new snowflake placed under the microscope is a possible great find, and almost surely will be new to science, for infinite variety is the rule. Hence it is an inexhaustible study and ever new. Of course, no one has as yet found the few matchless snowflakes that every storm furnishes.

Photographing Crystals

"The task of photographing snow crystals, although very delicate, is by no means difficult. The utmost haste must be taken, for, once the flakes are separated, evaporation (not melting) rapidly wears them away, even during intense cold.

"The crystals are usually caught on a blackboard as they fall from the sky and are picked up by a short, pointed splint, and placed on a glass slide for observation under a microscope. A brief glimpse, holding one's breath meanwhile, is given them, and if suitable, they are pressed down flat upon the glass slide by a feather, and the glass slide containing the flake is placed on the stage of the microscope, centered, focused, and an exposure of from eight seconds to several minutes is given, according to cloudiness and magnification. Ordinary daylight is used for illumination, the apparatus being merely pointed through a window for that purpose. Although comparatively easy to photograph, the subsequent processes employed on the negative to show them up naturally, white on a dark ground, are tedious. This consists of removing the film of the negative from around the image of the snowflake by cutting and scraping it away. It takes three or four solid hours of work on each of the branchy forms to do this, and all in all, it has been a monumental work of great difficulty, employing all the loving patience of the true scientist.

"Snow crystals are remarkable in many ways, for quantity, distribution, origin, and the all-important part they play in Nature's plan. They are perhaps the most exquisite examples of Nature's art. Although built usually according to the rule of six, every crystal grows in kaleidoscopic fashion from start to finish, and almost every moment in cloudland sees them changing form.

"These ever-varying outgrowth shapes, while uniting with the parent crystal, ofttimes do so imperfectly, thus imprisoning or bridging over tiny quantities of air, forming tiny air tubes within them, or diffuse shadings, which outline more or less perfectly the transitionary shapes. These present the appearance of minute lines, rods, dots, and fairy-like geometrical figures in endless variety, and give exquisite beauty, richness and complexity to their interiors. I have photographed over 3,800 snowflakes, and yet no two are alike, and it seems as easy as ever to find new and unique designs. These snowflake photomicrographs I have made are now world famous, the theme and inspiration of numerous writers and scientists, the delight of lecturers and 'movie' fans, used largely in educational ways in the universities, the University of Wisconsin alone having 2,200 slides of them. The flakes are found useful also in the arts and sciences, and as designs in artcraft shops and for jewelry designing.

"The great appreciation they have received has amazed me. I did not dream when I began this little, seemingly unimportant study, of their great future, the great good they would do, the enjoyment they would give to millions of people. For twelve years I carried on the work absolutely without recognition, all out financially and nothing coming in. All through these early years of my work I was greatly hampered by want of means, by hard struggles to earn a livelihood and pay off a mortgage on my home and farm, and care for an invalid mother. And yet persistence won out. I simply had such an intense love for my work that nothing could turn me from it."

Beauty in Water Forms

"But," continued Mr. Bentley, "while snowflakes, among all my photographic studies, have been my first love and have always appealed most strongly to me, yet the great beauty and diversity of other water forms, such as frost, ice, dew, rain, clouds and hail, also have had a strong attraction both to my mind and camera, and they, too, have furnished me with years of pleasure. In all nature there is nowhere to be found a series of forms more marvelous or more important to nature's plan than in water forms.

"These considerations led me to carry on a systematic study, both photographic and otherwise, of all water forms occurring in my locality. With the ability later developed to picture them with completeness I have obtained many hundreds of wonderful photographs each of frost, ice, dew, hail, rain and clouds together with a vast amount of data regarding them.

"In general, the magnification required to show water forms is relatively small—only a few diameters. Hence, in most cases, an ordinary small portrait lens, if coupled with an extension camera of extra length, serves admirably. Perhaps, after the snowflakes in beauty and diversity, comes the frost, especially window frost. The crystals are easily photographed. The camera is placed indoors and pointed out of a window. A black background is arranged outside of and at varying distances from the window, according to the magnification required. The frost crystals are thus illuminated by oblique, or incidental, light and shown white on a dark ground. The windows inside a room always kept cold display the richest specimens. It is an absorbingly fascinating task on a zero morning to search out and photograph the tiny crystals on each window pane where Jack Frost has wrought his masterpieces of hoary art, ofttimes seemingly fashioned in imitation of natural objects such as ferns and trees or of such man-made designs as castles or lace.

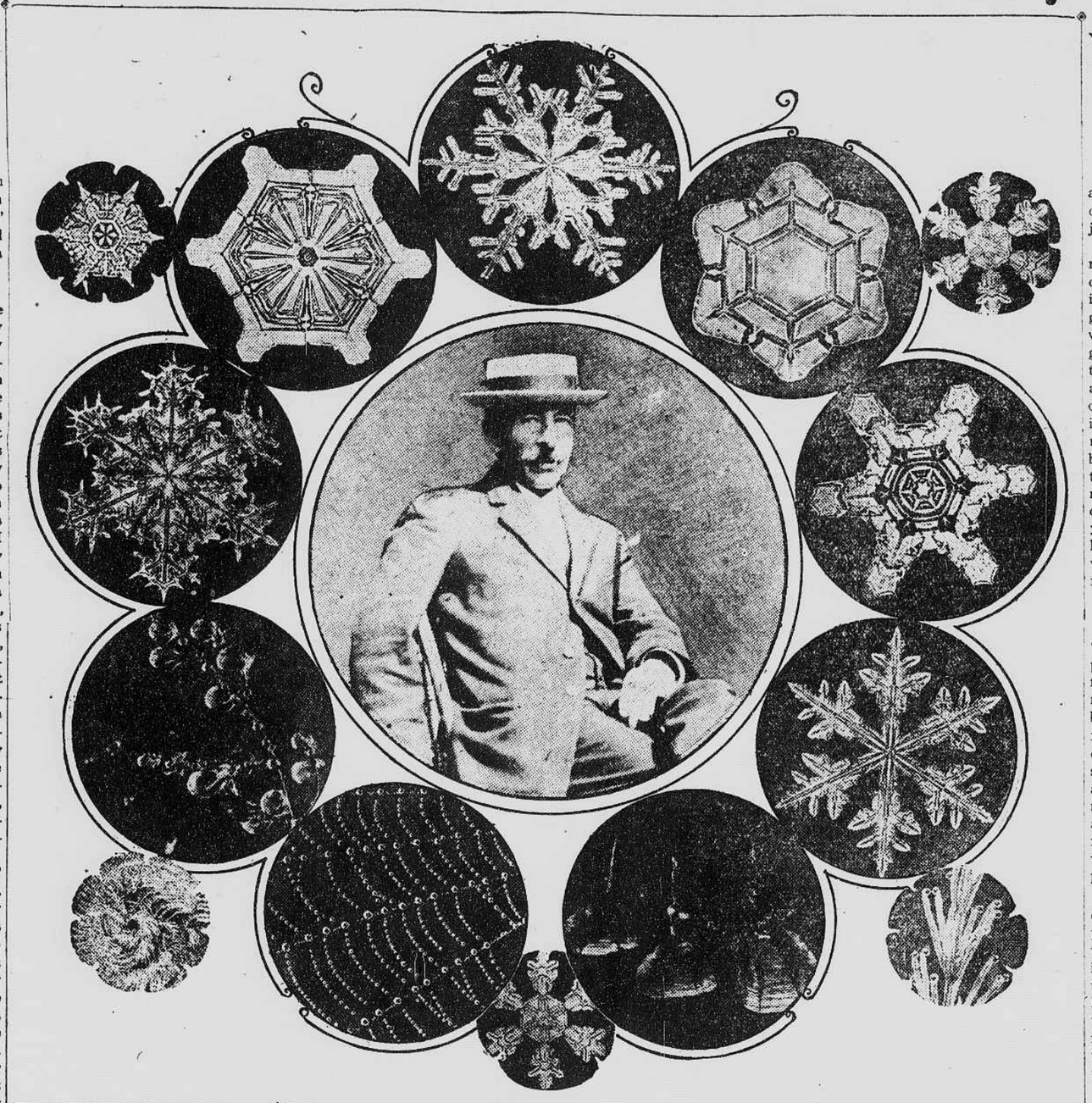
"As I gained more experience, the beauties of dew, rain drops and clouds each in turn excited my curiosity and admiration. The dew especially which collects so charmingly and variedly upon different objects seemed worthy of my best photographic efforts. A dewy scene in the early morning, while spiders' webs gleam with drops of iridescent hues, as though strung with myriads of pearls and opals, and while meadows, hillsides and all vegetal nature sparkle with spectral colors, is indeed nature's choicest work of art. The loveliness seems even enhanced when examined and photographed in detail. One is also impressed with the important part the dew takes in conserving plant life and supplying its moisture. The dew, rain and snow are the main links in the system whereby whole continents are irrigated from water carried through the atmosphere from the ocean, and all without man's aid.

Dew Pictures Easy

"I found dew photography quite easy. One proceeds much as with window frost, by photographing against a black background. The chief difficulty is the early morning breezes which sway objects and thus cause blurred likenesses of the dew drops. I often overcome this difficulty by screening the objects to be photographed with windows, leaving an opening only toward the camera.

"Of all the water forms I have photographed ice crystals on the surface of water have been the most unattainable. Yet, by a little study and persistency I have succeeded.

"The moral to be drawn from my experiences seems to be, provided one has an aptitude along any given line, is to take up a hobby and follow it through life. A seemingly unimportant study sometimes brings unexpected results. In any event, one's life will have a definite aim, will be enriched by a thorough knowledge of at least one thing and will be an example to others. I have devoted almost my whole life to the study of a very small part of nature, to a part of it to which few people ever give more than a moment's consideration. Yet with that small part my life has been made industrious."



WILSON ALWYN BENTLEY and some of the photographs of snowflakes taken by him

Feef and Meemuh --- By Booth Tarkington

Continued from preceding page

...ough. She says she's fixing to ...sh 'em."

Julia smiled faintly. "I thought ...e would. I had to go so far as to ...ll her that as long as I was house...eeper in my father's house she'd ...o what I said or find some other ...ace. She behaved outrageously ...d pretended to believe the natural ...lor of Fifi and Mimi was gray!"

"I expect," said Florence, after ...ndering seriously for a little while, "I expect it would take quite some ...me to dry them."

"No doubt. But I'd rather you ...dn't assist. I'd rather you weren't ...und looking on, Florence." A shade fell upon her niece's face ...stantly. "Why, Aunt Julia, I couldn't ...e any harm to Fifi and Mimi just ...okin' at 'em, could I? I don't see ...at"——

Julia laughed. "That's the trouble; ...u never do 'just look' at anything ...u're interested in, and, if you ...n't mind my saying so, you've got ...other a record, dear. Now, don't ...ke care; you can find lots of other ...easant things to do at home—or ...er at Herbert's, or Aunt Fanny's. ...ow run along now and"——

"Well"—— Florence said, moving ...t if to depart.

"You might as well go out by the ...ont door, child," Julia suggested ...th a little watchful urgency. "You ...me over some day when Fifi and ...mi have got used to the place and ...u can look at them all you want ...."

"Well, I just"——

But as Florence seemed disposed ...t to linger, her aunt's manner be...me more severe; she half rose ...om her reclining position for em...asis.

"...p, I really mean it! Fifi and ...mi are royal bred Persian cats ...th a wonderful pedigree, and I ...n't know how much trouble and ...pense it's cost Mr. Sanders to get ...em for me. They're utterly dif...rent from ordinary cats; they're ...ite and queer, and if anything ...ppened to them, after all the ...ouble Mr. Sanders's made over other ...ts he had, I'd go straight to a sanitarium! No, Florence, you keep away from the kitchen to-day, and I'd like to hear the front door as you go out."

"Well"—— said Florence, and departed.

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TWENTY is an unsuspicious age, except when it fears that its dignity or grace may be threatened from without; and it might have been a "bad sign" in revelation of Julia Atwater's character if she had failed to accept the muffled metallic clash of the front door's closing as a token that her niece had taken a complete departure from the premises. A supplemental confirmation came a moment later, fainter but no less conclusive: the distant slamming of the front gate, and it made a clear picture of an obedient Florence on her homeward way. Peace came upon Julia; she read in her book, while at times she dropped a languid, graceful arm, and, with the pretty hand at the slimmer end of it, groped in a dark shelter beneath her couch, made a selection, merely by her well experienced sense of touch, from a frilled white box that lay in concealment there; . . . and this without removing her shadowy eyes from the little volume and its patient struggle for dignified rhymes with "Julia." Florence was no longer in her beautiful relative's idlest thoughts.

Florence was idly in the thoughts, however, of Mrs. Balche, the next-door neighbor to the south. Happening to glance from a bay window, she negligently marked how the child walked to the front gate, opened it, paused for a moment's meditation, then hurled the gate to a vigorous closure, herself remaining within its protection. "Odd!" Mrs. Balche murmured.

Having thus eloquently closed the gate, Florence slowly turned, then moved toward the rear of the house, quickening her steps as she went, until at a run she disappeared from the scope of Mrs. Balche's gaze, cut off by the intervening foliage of Mr. Atwater's small orchard. Mrs. Balche felt no great interest; nevertheless she paused at the sound of a boy's voice, half husky, half shrill, in an early stage of change. "What she say, Flor'nce? D'she say we could?" But there came a warning, "Hush up!" from Florence in a harsh whisper. Then, in a lowered tone, the boy's voice said: "Look here; these are mighty funny actin' cats. I think they're kind of crazy or somep'm. Kitty Silver's fixed a washtub full o' suds for us."

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MRS. BALCHE was reminded of her own cat, and went to give it a little cream. Mrs. Balche was a retired widow, without children, and too timid to like dogs; but after a suitable interval, following the loss of her husband, she had accepted from a friend the gift of a white kitten, and named it Violet. It may be said that Mrs. Balche, having few interests in life, and being of a sequestering nature, lived for Violet, and that so much devotion was not good for the latter's health. In his youth, after having shown sufficient spirit to lose an eye during a sporting absence of three nights and days, Violet was not again permitted enough freedom of action to repeat this disloyalty—though in his advanced middle age he had been fed to such a state that he seldom cared to move, other than by a slow, sneering wavement of the tail when friendly words were addressed to him; and consequently, as he seemed beyond all capacity or desire to run away, or to run at all, Mrs. Balche had given him the run of the place. She found him now, asleep upon her back porch, and placed beside him a saucer of cream, the second since his luncheon. . . .

Violet took his cream without enthusiasm, pausing at times and turning his head away. In fact, he persisted only out of an incorrigible sensuality, and finally withdrew a pace or two, leaving creamy traces still upon the saucer. With a multitude of fond words his kind mistress drew his attention to these, and, making a visible effort, he returned and disposed of them.

"Dat's de 'itty darlin'," she said, stooping to stroke him. "Eat um all up nice clean. Dood fo' ole sweet sin!" She continued to stroke him, and Violet half closed his eye, not with love and serenity, but rather, as he simultaneously curvingly gestured with his tail, in a kind of impotent menace, meaning to say, "Oh, for Heaven's sake, take your hands off o' me!" Then he opened the eye and paid a little, instinctive attention to sounds from the neighboring yard. A high fence, shrubberies, and foliage concealed that yard from the view of Violet, but the sounds were eloquent to him, since they were those made by members of his own general species when threatening atrocities. The accent may have been foreign, but Violet caught perfectly the sense of what was being said, and instinctively he muttered reciprocal curses within himself.

"Wat a matta, honey?" his companion inquired sympathetically. "Ess, bad people f'ighten poor Violet!"

From beyond the fence came the murmurings of a boy and a girl in hushed but urgent conversation; and with these sounds there mingled watery agitations, splashings and the like, as well as low vocalizings which Violet had recognized—then there were muffled explosions, like fireworks choked in featherbeds; and the human voices grew uncontrollably somewhat louder, so that their import was distinguishable. "Ow!" "Hush up, can't you? You want to bring the whole town to—Ow!" "Hush up yourself—oh, goodness!" "Look out—don't let her"—— "Ow!"

Then came a hushed, husky voice, inevitably that of a horrified colored person hastening from a distance: "Oh, my Gawd!" There was a scurrying, and the girl was heard in furious yet hoarsely guarded vehemence: "Bring the clo'es prop! Bring the clo'es prop! We can poke that one down from the garage, anyway. Oh, look at her go!"

Mrs. Balche shook her head. "Naughty children!" she said, as she picked up the saucer and went to the kitchen door, which she held open for Violet to enter. "Want to come with mamma?"

But Violet had lost even the faint interest in life he had shown a few moments earlier. He settled himself to another stupor in the sun. . . .

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SUNSET was beginning to be hinted, two hours later, when, in another quarter of the town, a little girl of seven or eight, at play on the domestic side of an alley gate, became aware of an older girl regarding her fixedly over the top of the gate. The little girl felt embarrassed and paused in her gayeties, enfolding in her arms her pet and playmate. "Howdy'do," said the stranger in a serious tone. "What'll you take for that cat?"

The little girl made no reply, and the stranger, opening the gate, came into the yard. She looked weary, rather bedraggled, yet hurried; her air was predominantly one of anxiety. "I'll give you a quarter for that cat," she said. "I want an all-white cat, but this one's only got that one gray spot over its eye, and I don't believe there's an all-white cat left in town, leastways that anybody's willing to part with. I'll give you twenty-five cents for it. I haven't got it with me, but I'll promise to give it to you day after to-morrow."

The little girl still made no reply, but continued to stare with widening eyes, and the caller spoke with desperation.

"See here," she said, "I got to have a whitish cat! That'n isn't worth more'n a quarter, but I'll give you 35 cents for her, money down, day after to-morrow."

At this the frightened child set the cat upon the ground and fled into the house. Florence Atwater was left alone; that is to say, she was the only human being left in the yard or in sight. Nevertheless, a human voice spoke, not far behind her. It came through a knot hole in the fence, and it was a voice almost of passion.

"You grab it!"

Florence stood in silence, motionless; there was a solemnity about her. The voice exhorted. "My goodness!" it said. "She didn't say she wouldn't sell it, did she? You can bring her the money like you said you would, can't you? I got mine, didn't I, almost without any trouble at all! My Heavens! Ain't Kitty Silver pretty near crazy? Just think of the position we've put her into! I tell you, you got to!"

But now Florence moved. She moved slowly at first; then with more decision and rapidity.

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THAT evening's dusk had deepened into starlit blue night when the two cousins, each with a scant uneasy dinner eaten, met by appointment in the alley behind their mutual grandfather's place of residence. Presently they climbed the back fence and approached the kitchen. Suddenly Florence lifted her right hand, and took between thumb and forefinger a lock of hair upon the back of Herbert's head.

"Well, for Heavenses' sakes!" he burst out, justifiably protesting.

"Hush!" Florence warned him. "Kitty Silver's talkin' to somebody in there. It might be Aunt Julia! C'm'ere!"

She led him to a position beneath an open lighted window of the kitchen. Here they sat upon the ground, with their backs against the stone foundation of the house, and listened to voices and the clink and swish of dishes being washed.

"She's got another ole colored darky woman in there with her," said Florence. "It's a woman belongs to her church and comes to see her 'most every evening. Listen; she's telling her about it. I bet we could have the real truth of it maybe better this way than if we went in and asked her right out. Anyway, it isn't eavesdropping if you listen when people are talkin' about you yourself. It's only wrong when it isn't any of your own bus"——

"For Heavenses' sakes hush up!" her cousin remonstrated. "Listen!"

"'No'm, Miss Julia, ma'am,' I say"—thus came the voice of Mrs. Silver—"'no'm, Miss Julia, ma'am, them the same two cats you han' me, Miss Julia, ma'am,' I say. 'Leas'wise,' I say, 'them the two same cats whut was in nat closed-up brown basket when I open it up an' take an' fix to wash 'em. Somebody might 'a' took an' change 'em 'fo' they got to me,' I say, 'Miss Julia, ma'am; but all the change happen to 'em sence they been in charge of me that's the gray whut comes off 'em whiles I washin' 'em an' dryin' 'em in corn meal an' flannel. I dunno how much washin' 'em change 'em, Miss Julia, ma'am,' I say—'cause how much they change or ain't change, that's fer you to say and me not to jedge.'"

"Lan' o' misery!" cried the visitor, chuckling delightedly. "I wonder how you done kep' you' face, Miss Kitty. What Miss Julia say?"

A loud, irresponsible outburst of mirth on the part of Mrs. Silver followed. When she could again control herself she replied more definitely. "Miss Julia say, she say she ain' never hear no sech outragelous sto'y in her life. She tuck on! Hallelujah! An' all time, Miz Johnson, I give you my word, I stannin' there holdin' nat basket, carryin' on up hill an' down dale, how them the same two Berjum cats Mista Sammerses sen' her; an' trouble enough dess ten'in' to that basket, lemme say to you, Miz Johnson, as anybody kin tell you whutever tried to take care o' two cats whut an't yoosta each other in the same basket. An' every blessed minute, I stannin' there, can't I hear that ole Miz Balche nex' do', out in her back yod an' her front yod, an' plum out in the street, hollerin': 'Kitty! Kitty! Kitty!' 'Yes!' Miss Julia say, she say. 'Fine sto'y!' she say. 'Them two cats you claim my Berjum cats, they got short hair, an' they ain't the same age an' they ain't even nowheres near the same size,' she say. 'One of 'em's as fat as bofe them Berjum cats,' she say; 'an' it's on'y got one eye,' she say. 'Well, Miss Julia, ma'am,' I say—'one thing; they come out white, all 'cept dess around that there skinnier one's eye,' I say; 'dess the same you tell me they goin' to,' I say. 'You right about that much, ma'am!' I say."

"Oh, me!" Mrs. Johnson moaned, worn with applausive laughter. "What she respon' then?"

"I set that basket down," said Kitty Silver, "an' I start fer the do', whiles she unfasten the lid fer to take one mo' look at 'em, I reckon; but open window mighty close by, an' nat skinny white cat make one jump, an' after li'l while I lookin' out this here window an' I see that ole fat Miz Balche's tom, waddlin' crost the yod todes home."

"What she doin' now?" Mrs. Johnson inquired.

"Who? Miss Julia? She settin' out on the front po'ch talkin' to Mista Sammerses."

"My name! How she goin' to fix it with him, after all this here dish-cumaraddle?"

"Who? Miss Julia? Leave her alone, honey! She take an' begin talk so fas' an' talk so sweet that young man ain't goin' to ricklect he ever give her no cats, not till he's gone an' halfway home! But I ain't tole you the en' of it, Miz Johnson, an' the en' of it's the bes' part whut happen."

"What's that, Miss Kitty?"

"Look!" said Mrs. Silver. "Mista Atwater gone in yonder, after I come out, an' ast whut all them goin's-on about. Well, suh, an' didn' he come walkin' out in my kitchen after dinnuh an' slip me two bright spang new silvuh dolluhs right in my han'?"

"My name!"

"Yessuh!" said Mrs. Silver triumphantly.

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IN the darkness outside the window Florence rose to her feet. "What you goin' to do?" Herbert asked.

Florence drew a deep breath and then made reply in an earnest and conscientious voice; and Herbert, as he listened, felt within his bosom—for the first time in his life, and profoundly in spite of himself—the stirring of a strong admiration for this girl cousin of his; admiration and a desire to emulate her now in word and deed.

"I think we've done very, very wrong," she said. "I don't want to go to bed to-night with all this on my mind, and I'm going to find grandpa right now," she concluded, "and confess every bit of it to him."